REMARKS

The Office Action of April 22, 2008 has been reviewed and the comments therein carefully considered. This application has been amended. Specifically, claim 17 has been amended to incorporate the limitations previously appearing in claims 18 and 20. Support for this amendment can be found in previously presented claim 20. Claims 18 and 20 have been cancelled. Claims 21 and 22 have been amended to address new claim dependencies resulting from the amendment to claim 17. In addition, claims 17, 21, 22, 31 and 33 have been amended to address minor typographical errors. Finally, claim 37 has been added, and support for this new claim can be found in the first paragraph on page 5 of the application as filed. Accordingly, no new matter has been added by this amendment and claims 17, 19 and 21-37 are currently pending.

Claim Objections

Claims 22 and 31 were objected to because of minor typographical errors appearing in the claims. These errors have now been corrected by amendment. Applicants have also reviewed the remaining claims and made several other corrections of minor typographical errors. It is believed these changes are sufficient to overcome the outstanding claim objections. Therefore, Applicants respectfully request withdrawal of the objections.

Rejections Under 35 U.S.C. §§ 102 and 103

Claims 17-21 and 25-36 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,730,730 to Hansen et al. Claims 17-21 and 25-36 also stand rejected under 35 U.S.C. § 102(b) as being anticipated by International Patent Application Publication No. 01/05725 to Hansen et al. Because both Hansen references are believed to contain the same disclosure, as the Hansen U.S. patent represents the national stage of the Hansen international application, these documents will be referred to collectively herein as "Hansen."

The claimed invention is directed to a formaldehyde-free aqueous binder composition comprising a first binder component and a second binder component. The first binder component (A) is obtained by reacting at least one alkanolamine with at least one carboxylic anhydride in an equivalent ratio of amine and hydroxyl groups (NH+OH) to carboxy groups (COOH) of at least 0.4. The second binder component (B) comprises at least

one carbohydrate. The equivalent ratio of amine and hydroxyl groups (NH+OH) to carboxy groups (COOH) in the final binder composition, which includes both binder (A) and binder (B), is 2.0 or less. The invention is also directed to a mineral fiber product and a method of producing a bonded mineral fiber product using the formaldehyde-free aqueous binder composition.

Hansen is directed to a compound suitable for use as a binder material. The binder is comprised of the reaction product of an amine, such as diethanolamine (DEA), and different cyclic anhydrides, such as tetrahydrophtalic anhydride (THPA) and trimellitic anhydride (TMA). Hansen does not disclose, teach or suggest a binder material that includes a carbohydrate component added to the binder where the equivalent ratio of amine and hydroxy groups (NH+OH) to carboxy groups (COOH) in the final binder composition is limited to a value of 2.0 or less. In fact, Hansen fails to discuss controlling or measuring the equivalent ratio of amine and hydroxy groups (NH+OH) to carboxy groups (COOH) at all.

Applicants' invention is based on the unexpected discovery that controlling the equivalent ratios of amine and hydroxy groups (NH+OH) to carboxy groups (COOH) not only in the binder component (A) itself, but also in the final binder composition binder system, which comprises binder component (A) together with a carbohydrate component (B), creates a binder system having good curing behavior, durability and humidity resistance. While not wishing to be bound to a particular theory, Applicants believe that employing a certain minimum equivalent ratio of amine and hydroxy groups (NH+OH) to carboxy groups (COOH) in the production of binder component (A) avoids the existence of excessive free unreacted acid, which can lead to the displacement of binder in the curing oven, *i.e.*, to a non-uniform distribution in the amount of binder between the bottom and top of a mineral wool mat or web. Further, high amounts of unreacted acid may increase corrosiveness of the system.

None of these problems, nor the technical solution proposed by the instant invention, are disclosed or suggested in the cited documents. Moreover, there is no recognition in any of these documents of the importance in maintaining certain equivalent ratios of amine and hydroxy groups (NH+OH) to carboxy groups (COOH) both in the binder component (A) itself and in the final binder composition comprising binder components (A) and (B) in order to obtain a viable binder system.

While it is true that Hansen refers in a superficial manner to polysaccharides

as an example of a binder additive, it is also true that Hansen does not actually contain a working example illustrating a binder system containing binder components (A) and (B) as claimed in the instant application, much less a binder system with the specific NH+OH to COOH ratio recited in the claims. A genus does not always anticipate a claim to a species within the genus, nor does the disclosure of a genus necessarily render a species obvious. *See* M.P.E.P. §§ 2131.02 and 2144.08.

Prior to Applicants' findings, it was simply unknown that a binder system having improved performance properties could be developed by controlling the NH+OH to COOH ratio in both the final binder product and the individual binder components. Instead, the common understanding was that carbohydrates were not expected to beneficially contribute to the curing behavior of the system or the physical properties of the bonded products. Rather, a deterioration of these properties was generally expected which outweighed the cost benefit of using these relatively cheap materials.

The present inventors have now found that it is possible to obtain a viable binder system employing carbohydrates as a component while still exhibiting surprisingly improved curing behavior and physical strength ("durability") of the bonded products. Such a binder system is possible as long as certain equivalent ratios of amine and hydroxy groups (NH+OH) to carboxy groups (COOH) are maintained both in the binder component (A) as well as in the final binder composition comprising binder components (A) and (B).

These unexpected results are demonstrated in the attached Declaration Under 37 C.F.R. §1.132 of Erling Lennart Hansen, a named inventor in this application. In his Declaration, Mr. Hansen compares binders according to the present invention comprising Binder Components (A) and (B) with corresponding binders comprising Binder Component (A) alone.

Mr. Hansen developed four different binder component A formulations, with each of these formulations having a ratio of (NH+OH):COOH of at least 0.4. (Hansen Declaration, page 2). Mr. Hansen then combined each of Binder Components A1 to A4 with Binder Component B, which comprised glucose syrup, to create Binders 1-6. (Hansen Declaration, pages 2 and 4). These binders, some of which contained no Binder Component B, were then analyzed to determine strength (Rod test) and moisture uptake (Flash curing test). (Hansen Declaration, pages 3-4).

From the Rod test, it was shown that one of the binders according to the present invention, Binder 4, surprisingly exhibited a significantly higher 3-point bending strength value of 5.3 N/mm^2 compared to Binder 5, comprised of Binder Component A alone, (bending strength value of 4.1 N/mm^2) even though the two binders had the same (NH+OH):COOH ratio of 1.6. (Hansen Declaration, page 4).

From the Flash curing test, it was shown that the binders according to the present invention (Binders 1, 2, and 4) surprisingly exhibited far less moisture uptake after curing at a curing temperature of 250°C than a comparative binder (Binder 3) not containing a Binder Component B within the claimed equivalent ranges (Hansen Declaration, page 4). Furthermore, the moisture uptake at 250°C of the binders according to the present invention (and containing Binder Component B) is of the same magnitude as the moisture uptake of Binder 3 (no Binder Component B) at 275°C, demonstrating that the inclusion of Binder Component B improves the binder curing behavior (Hansen Declaration, page 4). Such improved curing behavior allows one using the binder of the current invention to, for example, create bonded mineral wool products while working at a lower curing temperature with reduced thermal decomposition of the bonded products (Hansen Declaration, page 4).

None of the cited documents of record is concerned with the problem of improving durability and curing behavior by using a carbohydrate binder component. Moreover, none of the cited documents of record teaches or suggests that certain equivalent ratios of amine and hydroxy groups (NH+OH) to carboxy groups (COOH) should be maintained both in the binder component (A) and in the final binder composition comprising binder components (A) and (B).

For the foregoing reasons, claims 17-21 and 25-36 are patentable over Hansen. Accordingly, Applicants respectfully request reconsideration and withdrawal of the outstanding rejections of claims 17-21 and 25-36.

Claims 22-24 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Hansen further in view of U.S. Patent No. 6,071,994 to Hummerich et al. In the Office Action, it is admitted that Hansen fails to disclose, teach, or suggest the addition of a starch in the amount recited in claims 22-24. Hummerich is cited in the Office Action as teaching the addition of a starch in such amounts. However, Hummerich, like Hansen, fails to disclose, teach or suggest a carbohydrate component that is added to the binder so that the equivalent ratio of amine and hydroxy groups (NH+OH) to carboxy groups (COOH) in the final binder

composition is limited to a value of 2.0 or less. Hummerich, like Hansen, also fails to teach or suggest controlling or measuring the equivalent ratio of amine and hydroxy groups (NH+OH) to carboxy groups (COOH) at all. Consequently, Hummerich fails to cure the deficiencies with respect to Hansen discussed above, and claims 22-24 are patentable over Hansen and Hummerich whether considered alone or in combination.

Double Patenting Rejections

Claims 17, 22-24, and 31-33 stand rejected for obviousness-type double patenting based upon claim 7 of commonly assigned U.S. Patent No. 6,730,730 (Hansen). In addition, claims 17, 22-24, and 31-33 stand rejected for obviousness-type double patenting based upon claim 7 of U.S. Patent No. 6,730,730 (Hansen) in view of Hummerich. In this amendment, Applicants have amended claim 17 to include the language previously appearing in claims 18 and 20. Because neither claim 18 nor claim 20 stands rejected for double-patenting, and further because each of claims 22-24 and 31-33 includes all of the limitations of claim 17, Applicants believe this rejection is now moot and should be withdrawn. In any event, the foregoing discussion makes clear that claims 17, 22-24, and 31-33 are not obvious in view of Hansen and Hummerich, alone or in combination.

CONCLUSION

For all of the foregoing reasons, Applicants submit that the pending claims are patentable over the cited documents of record and are in condition for allowance. Accordingly, withdrawal of the outstanding rejections and allowance of claims 17, 19, and 21-37 are respectfully requested.

Respectfully submitted,

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